Bachelor Level / First Year /Second Semester/Science
Computer Science and Information Technology (CSc 152)
(Discrete Structure)

Full Marks: 80
Pass Marks: 32
Time: 3 hours

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Attempt all questions:

Group A

(10×2=20)

1. Define disjunction and conjunction with suitable examples.
2. Is the following argument valid?

   Smoking is healthy.
   If smoking is healthy, then cigarettes are prescribed by physicians.
   ∴ Cigarettes are prescribed by physicians.

3. State the rules for the strong form of mathematical induction with propositions.
4. State and prove "the extended pigeonhole principle".
5. Define the terms a language over a vocabulary and the phrase - structure grammar.
6. Distinguish between binary tree and spanning tree with suitable examples.
7. Consider K_n, the complete graph on n vertices. What is the degree of each vertex?
8. Explain the state transition function of the finite state machine with a suitable table.
9. Define regular expressions over a non-empty set A.
10. What is the chromatic number of the complete bipartite graph $K_{m,n}$ where m and n are positive integers.

Group B

(5×4=20)

1. Explain the rules of inference for quantified statements.
2. Let A = { p, q, r}. Give the regular set corresponding to the regular expression given:

   (a) $(p \vee q)\, r\, q^*$ (b) $p(q\ q)^*\, r$.

12. Find an explicit formula for the Fibonacci sequence defined by $f_n = f_{n-1} + f_{n-2}$, $f_1 = f_2 = 1$.

13. Define finite - state machines with output.

14. Show that the maximum number of vertices in a binary tree of height n is $2^{n+1} - 1$.

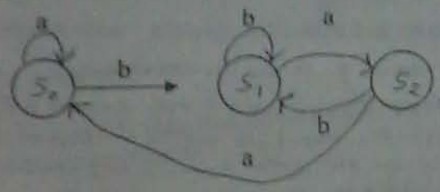
OR

Draw all possible unordered trees on the set {a, b, c}.

Group C

(5×8=40)

16. Construct the state transition table of the finite - state machine whose diagraph is shown?



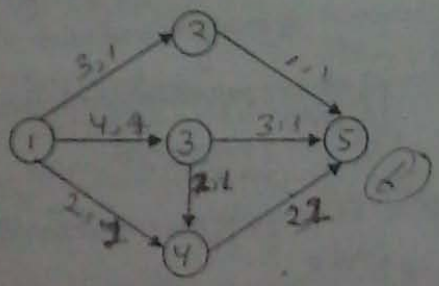
	a	b
S_0	S_0	S_1
S_1	S_2	S_1
S_2	S_0	S_1

17. Let G = (V, S, v_0, $\mapsto$), where V = {v_0, x, y, z}, S = {x, y, z} and

$\mapsto$: $v_0 \mapsto xv_0$
$v_0 \mapsto yv_0$
$v_0 \mapsto z$.

What is L(G), the language of this grammar?

18. Find a maximum flow in the network shown in figure.



19. Prove that a symmetric connected relation has a undirected spanning tree.

OR

Give a simple condition on the weights of a graph that will guarantee that there is a unique maximal spanning tree for the graph.

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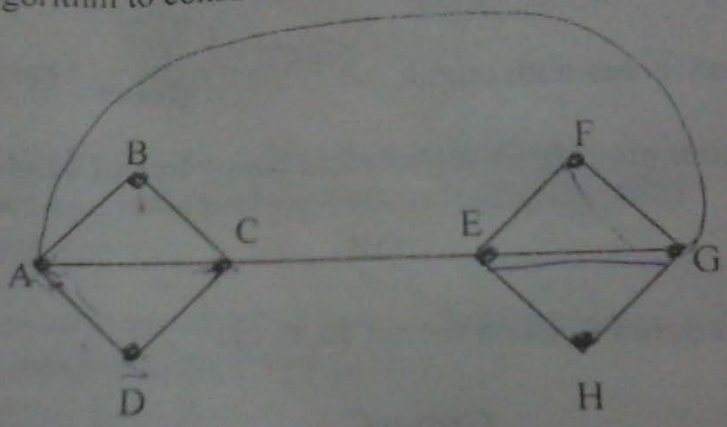
20. Use Fleuris algorithm to construct an Euler circuit for the following graph.



OR

Explain the concept of network flows and max-flow min-cut with suita

Assume that T is tree. Then T is a connected g